(9) CLAIMS

1. A data storage disk device comprising:

a substrate; and

on a surface of the substrate, a data recording medium, wherein said medium is a molecular colorant in which each molecule is reversibly switchable via a localized electrical field for selecting one of at least two optically differentiated states and wherein predetermined regions of said layer are used for erasably writable data bit storage.

2. The device as set forth in claim 1 comprising:

said at least two optically differentiated states are defined by molecular-level spectral absorptive characteristics, molecular-level reflective characteristics, molecular-level refractive characteristics, molecular-level transmissive characteristics, or combinations thereof.

3. The device as set forth in claim 1 comprising:

said at least two optically differentiated states are defined by molecular-level differential spectral reflective characteristics.

4. The device as set forth in claim 1 comprising:

said at least two optically differentiated states are defined by molecular-level spectral absorptive characteristics.

5. The device as set forth in claim 1 comprising:

said at least two optically differentiated states are defined by molecular-level differential spectral refractive index characteristics.

6. The device as set forth in claim 1 comprising:

said at least two optically differentiated states are defined by molecular-level differential spectral transmissive characteristics.

7. The device as set forth in claim 1 comprising:

each said molecule is bichromal and bistable or multichromal and multistable.

8. The device as set forth in claim 1 comprising:

each said molecule exhibits a bistable or multistable electric field induced band gap change.

9. The device as set forth in claim 8 comprising:

said band gap change occurs via a molecular conformation change or an isomerization.

10. The device as set forth in claim 9 comprising:

each said molecule has at least one stator portion and at least one rotor portion, wherein said rotor portion rotates from a first state to a second state

selectively via said localized electrical field, wherein in the first state there is extended conjugation resulting in a relatively small band gap, and in said second state said extended conjugation is altered resulting in a relatively larger band gap.

11. The device as set forth in claim 9 comprising:

dependent upon direction of the localized electrical field applied, in the first state the molecule is in a more conjugated state having a relatively smaller band gap and in the second state the molecule are in a less conjugated state having a relatively larger band gap.

12. The device as set forth in claim 8 comprising:

said electric field induced band gap change occurs via a change of extended conjugation via chemical bonding change to change the band gap.

13. The device as set forth in claim 12 comprising:

said electric field induced band gap change occurs via a change of extended conjugation via charge separation or recombination accompanied by increasing or decreasing band localization.

14. The device as set forth in claim 12 comprising:

a change from a first state to a second state occurs with an applied electric field, said change involving charge separation in changing from said

first state to said second state, resulting in a relatively larger band gap state, with less π-delocalization, and recombination of charge in changing from said second state to said first state, resulting in a relatively smaller band gap state, with greater π-delocalization.

15. The device as set forth in claim 8 comprising:

said electric field induced band gap change occurs via a change of extended conjugation via charge separation or recombination and π-bond breaking or formation.

16. The device as set forth in claim 15 comprising:

a change from a first state to a second state occurs with an applied electric field, said change involving charge separation in changing from said first state to said second state, wherein in said first state there is extended conjugation throughout with a separation of positive and negative charge, resulting in a relatively smaller band gap state, and wherein in said second state said extended conjugation is destroyed or partially interrupted and separated positive and negative charges are recombined, resulting in a relatively larger band gap state .

17. The device as set forth in claim 8 comprising:

said electric field induced band gap change occurs via a molecular folding or stretching.

18. The device as set forth in claim 17 comprising:

said molecule has three portions, a first portion and a third portion, each bonded to a second, central portion, wherein a change from a first state to a second state occurs with an applied electric field, said change involving a folding or stretching about of said second portion, wherein in said first state there is extended conjugation, resulting in a relatively smaller band gap state, and wherein in said second state, said extended conjugation is altered or destroyed, resulting in a relatively larger band gap.

19. A disk drive apparatus comprising:

a disk, having a recording medium formed of at least one stratum forming a lattice of molecules wherein each molecule is at least bichromal and switchable between at least two bistable optical characteristic differentiated molecular states such that each of said states represents a predetermined data bit;

a motor coupled to said disk for providing rotational motion thereto;

proximate said recording layer, a writing stylus for selectively imparting electrical fields to said molecules for writing and erasing a data bit;

proximate said recording layer, a photo-optical device for transmitting to said layer and receiving from said layer spectral radiation wherein said each data bit is read from said disk; and

a controller, connected to said motor, said writing stylus, and said photo-optical device and providing electrical controls therefor.

20. The apparatus as set forth in claim 19 comprising;

each data bit is one of said states, differentiated at a given spectral band used to read the data bits as a first state wherein a molecule is photon absorbent and a second state wherein a molecule is photon transparent.

21. The apparatus as set forth in claim 19 comprising:

each data bit is one of said states, differentiated at a given spectral band used to read the data bits as a first state defined by a molecular-level differential first spectral reflective characteristic and a molecular-level differential second spectral reflective characteristic.

22. The apparatus as set forth in claim 19 comprising:

each data bit is one of said states, differentiated at a given spectral band used to read the data bits as first state defined by a molecular-level first spectral absorptive characteristic and a molecular-level second spectral absorptive characteristic.

23. The apparatus as set forth in claim 19 comprising:

said states are defined by molecular-level differential spectral refractive index characteristics.

24. The apparatus as set forth in claim 19 comprising:

each said molecule exhibits a bistable or multistable electric field

induced band gap change.

25. The apparatus as set forth in claim 19 wherein said photo-optical device includes means for differentiating reflective and transmissive characteristics of regions of said lattice, or differential reflective or differential absorptive characteristics of regions of said lattice, or differential refractive indexed characteristics of regions of said lattice, or combinations thereof as representative of specific data states.

26. A disk memory comprising:

substrate means for forming a disk shaped substrate; and

memory means for forming a recording layer on said substrate such that said layer is an electro-optical colorant having electrically switchable, at least bistable and at least bichromal molecules in a matrix structure wherein each of said molecules may be erasably set to a memory state representative of a data bit.

27. The disk memory as set forth in claim 26 wherein said molecules are each selectively switchable between at least two optically distinguishable states.

28. The disk memory as set forth in claim 26 wherein said molecules exhibits a bistable electric field induced band gap change.

29. The disk memory as set forth in claim 26 wherein said colorant is a plurality of stratum of said matrix structure forming a regular lattice of said molecules such that predetermined volumes of said colorant form predetermined targetable positions of said memory means wherein each of said positions is an addressable memory location.

30. A method for storing data on a disk, the method comprising:

affixing a colorant onto a recording surface of said disk wherein said colorant is a substantially uniform layer of molecules wherein each molecule thereof is at least bichromal and at least bistable and selectively switchable between at least two optically distinct states by localized electrical fields; and

storing data on said disk by selectively manipulating said localized electrical fields for forming digital data bits via setting said distinct state in predetermined regions of said colorant.

31. The method as set forth in claim 30 wherein a storage data density characteristic of said disk is defined by approximating an area of said colorant substantially equal to size of a single molecule.

32. The method as set forth in claim 30 wherein a storage data density characteristic of said disk is defined by a predetermined area approximately equal to a predetermined optically targetable region of said colorant.

33. The method as set forth in claim 30 wherein said data is rewritable via selectively manipulating said localized electrical fields.

34. The method as set forth in claim 30 wherein said two optically distinct states are predetermined for reading said data bits via a given spectral band used related to said states.

35. A method for erasably writing on an electrical field addressable rewritable disk medium, the method comprising:

providing a disk-shaped substrate having at least one layer of a molecular colorant coating wherein molecules of the coating are at least bichromal and subjectable to switching between stable states under influence of a localized electric field and wherein said layer is distributed across said substrate forming targetable individual data bit locations on said medium; and

electrically addressing said locations by selectively controlling each said localized electric field to form erasably memorized data content on said medium such that each of said locations is optically readable as a data bit.

36. A digital data memory system comprising:

a rotatable disk having a surface; and

means for storing optically discernable digital data bits on said surface, said means for storing further comprising a molecular colorant further comprising a matrix of molecules wherein each molecule is a bistable,

bichromal, electro-optical switch.

37. The system as set forth in claim 36 comprising:

said means for storing is a molecularly self-assembling, interconnected stratum forming a uniform, spaced, conjugated, molecular lattice structure.

38. The system as set forth in claim 36 comprising:

each said switch has two optically differentiated states defined by molecular-level spectral absorptive characteristics, molecular-level reflective characteristics, molecular-level refractive characteristics, molecular-level transmissive characteristics, or combinations thereof.

39. The system as set forth in claim 36 comprising:

each said molecule exhibits a bistable band gap change under influence of a localized electrical field.

40. The system as set forth in claim 36 further comprising:

means for writing and erasing digital data on said means for storing; and

means for reading digital data from said means for storing.